mucopolysaccharidosis type IV

Mucopolysaccharidosis type IV (MPS IV), also known as Morquio syndrome, is a progressive condition that mainly affects the skeleton. The rate at which symptoms worsen varies among affected individuals.

The first signs and symptoms of MPS IV usually become apparent during early childhood. Affected individuals develop various skeletal abnormalities, including short stature, knock knees, and abnormalities of the ribs, chest, spine, hips, and wrists. People with MPS IV often have joints that are loose and very flexible (hypermobile), but they may also have restricted movement in certain joints. A characteristic feature of this condition is underdevelopment (hypoplasia) of a peg-like bone in the neck called the odontoid process. The odontoid process helps stabilize the spinal bones in the neck (cervical vertebrae). Odontoid hypoplasia can lead to misalignment of the cervical vertebrae, which may compress and damage the spinal cord, resulting in paralysis or death.

In people with MPS IV, the clear covering of the eye (cornea) typically becomes cloudy, which can cause vision loss. Some affected individuals have recurrent ear infections and hearing loss. The airway may become narrow in some people with MPS IV, leading to frequent upper respiratory infections and short pauses in breathing during sleep (sleep apnea). Other common features of this condition include mildly "coarse" facial features, thin tooth enamel, multiple cavities, heart valve abnormalities, a mildly enlarged liver (hepatomegaly), and a soft out-pouching around the belly-button (umbilical hernia) or lower abdomen (inguinal hernia). Unlike some other types of mucopolysaccharidosis, MPS IV does not affect intelligence.

The life expectancy of individuals with MPS IV depends on the severity of symptoms. Severely affected individuals may survive only until late childhood or adolescence. Those with milder forms of the disorder usually live into adulthood, although their life expectancy may be reduced. Spinal cord compression and airway obstruction are major causes of death in people with MPS IV.

Frequency

The exact prevalence of MPS IV is unknown, although it is estimated to occur in 1 in 200,000 to 300,000 individuals.

Genetic Changes

Mutations in the *GALNS* and *GLB1* genes cause MPS IV. These genes provide instructions for producing enzymes involved in the breakdown of large sugar molecules called glycosaminoglycans (GAGs). GAGs were originally called mucopolysaccharides,

which is where this condition gets its name. When MPS IV is caused by mutations in the *GALNS* gene it is called MPS IV type A (MPS IVA), and when it is caused by mutations in the *GLB1* gene it is called MPS IV type B (MPS IVB). In general, the two types of MPS IV cannot be distinguished by their signs and symptoms.

Mutations in the *GALNS* and *GLB1* genes reduce or completely eliminate the activity of the enzymes produced from these genes. Without these enzymes, GAGs accumulate within cells, specifically inside the lysosomes. Lysosomes are compartments in the cell that break down and recycle different types of molecules. Conditions such as MPS IV that cause molecules to build up inside the lysosomes are called lysosomal storage disorders. In MPS IV, GAGs accumulate to toxic levels in many tissues and organs, particularly in the bones. The accumulation of GAGs causes the bone deformities in this disorder. Researchers believe that the buildup of GAGs may also cause the features of MPS IV by interfering with the functions of other proteins inside lysosomes and disrupting the movement of molecules inside the cell.

Inheritance Pattern

This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.

Other Names for This Condition

- Morquio-Brailsford disease
- Morquio Disease
- Morquio Syndrome
- Morquio's Disease
- Morquio's Syndrome
- MPS IV
- mucopolysaccharidosis (MPS) IV (A, B)

Diagnosis & Management

Genetic Testing

- Genetic Testing Registry: Morquio syndrome
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C0026707/
- Genetic Testing Registry: Mucopolysaccharidosis, MPS-IV-A
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C0086651/
- Genetic Testing Registry: Mucopolysaccharidosis, MPS-IV-B
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C0086652/

Other Diagnosis and Management Resources

- MedlinePlus Encyclopedia: Morquio syndrome
  https://medlineplus.gov/ency/article/001206.htm

General Information from MedlinePlus

- Diagnostic Tests
  https://medlineplus.gov/diagnostictests.html
- Drug Therapy
  https://medlineplus.gov/drugtherapy.html
- Genetic Counseling
  https://medlineplus.gov/geneticcounseling.html
- Palliative Care
  https://medlineplus.gov/palliativecare.html
- Surgery and Rehabilitation
  https://medlineplus.gov/surgeryandrehabilitation.html

Additional Information & Resources

MedlinePlus

- Encyclopedia: Cloudy cornea
  https://medlineplus.gov/ency/article/003317.htm
- Encyclopedia: Hypermobile joints
  https://medlineplus.gov/ency/article/003295.htm
- Encyclopedia: Knock knees
  https://medlineplus.gov/ency/article/001263.htm
- Encyclopedia: Morquio syndrome
  https://medlineplus.gov/ency/article/001206.htm
- Encyclopedia: Mucopolysaccharides
  https://medlineplus.gov/ency/article/002263.htm
- Health Topic: Carbohydrate Metabolism Disorders
  https://medlineplus.gov/carbohydratemetabolismdisorders.html

Genetic and Rare Diseases Information Center

- Mucopolysaccharidosis type IVA
  https://rarediseases.info.nih.gov/diseases/3785/mucopolysaccharidosis-type-iva

Additional NIH Resources

- National Institute of Neurological Disorders and Stroke: Mucopolysaccharidosis Fact Sheet
  https://www.ninds.nih.gov/Disorders/All-Disorders/Mucopolysaccharidoses-Information-Page

Educational Resources

- Disease InfoSearch: Morquio Syndrome
  http://www.diseaseinfosearch.org/Morquio+Syndrome/4875
- MalaCards: mucopolysaccharidosis iv
  http://www.malacards.org/card/mucopolysaccharidosis_iv
- My46 Trait Profile
  https://www.my46.org/trait-document?trait=Mucopolysaccharidosis%20Type%20IV&type=profile
- Orphanet: Mucopolysaccharidosis type 4
  http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=582

Patient Support and Advocacy Resources

- Canadian Society for Mucopolysaccharide & Related Diseases, Inc.
  http://www.mpssociety.ca/
- Lysosomal Diseases New Zealand
  http://www.ldnz.org.nz/
- MorquioB.com: Dedicated to Morquio B (MPS IVB) Funding and Research
  http://www.morquiob.com/
- National MPS Society
  http://mpssociety.org/mps/mps-iv-morquio/
- National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/morquio-syndrome/
- Resource list from the University of Kansas Medical Center: Mucopolysaccharidosis Syndromes
  http://www.kumc.edu/gec/support/mucopoly.html
- The Carol Ann Foundation & International Morquio Organization
  http://www.morquio.com
- The MPS Society (UK)
  http://www.mpssociety.org.uk/diseases/mps-diseases/mps-iva-ivb/

ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22mucopolysaccharidosis+type+IV%22

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28mucopolysaccharidosis+type+IV%5BTIAB%5D%29+OR+%28MPS+IV%5BTI%5D%29+OR+%28Morquio+syndrome%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- MUCOPOLYSACCHARIDOSIS, TYPE IVA
  http://omim.org/entry/253000
- MUCOPOLYSACCHARIDOSIS, TYPE IVB
  http://omim.org/entry/253010

Sources for This Summary

- Montaño AM, Sukegawa K, Kato Z, Carrozzo R, Di Natale P, Christensen E, Orii KO, Orii T, Kondo N, Tomatsu S. Effect of 'attenuated' mutations in mucopolysaccharidosis IVA on molecular phenotypes of N-acetylgalactosamine-6-sulfate sulfatase. J Inherit Metab Dis. 2007 Oct;30(5): 758-67. Epub 2007 Sep 17.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17876718
- Montaño AM, Tomatsu S, Gottesman GS, Smith M, Orii T. International Morquio A Registry: clinical manifestation and natural course of Morquio A disease. J Inherit Metab Dis. 2007 Apr;30(2):165-74. Epub 2007 Mar 8.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17347914
- Santamaria R, Chabás A, Callahan JW, Grinberg D, Vilageliu L. Expression and characterization of 14 GLB1 mutant alleles found in GM1-gangliosidosis and Morquio B patients. J Lipid Res. 2007 Oct; 48(10):2275-82. Epub 2007 Jul 30.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17664528
- Santamaria R, Chabás A, Coll MJ, Miranda CS, Vilageliu L, Grinberg D. Twenty-one novel mutations in the GLB1 gene identified in a large group of GM1-gangliosidosis and Morquio B patients: possible common origin for the prevalent p.R59H mutation among gypsies. Hum Mutat. 2006 Oct;27(10):1060.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16941474

- Tomatsu S, Montaño AM, Lopez P, Trandafirescu G, Gutierrez MA, Oikawa H, Nishioka T, Vieira MB, Orii T, Noguchi A. Determinant factors of spectrum of missense variants in mucopolysaccharidosis IVA gene. Mol Genet Metab. 2006 Sep-Oct;89(1-2):139-49. Epub 2006 Jul 11.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16837223
- Tomatsu S, Montaño AM, Nishioka T, Gutierrez MA, Peña OM, Tranda Firescu GG, Lopez P, Yamaguchi S, Noguchi A, Orii T. Mutation and polymorphism spectrum of the GALNS gene in mucopolysaccharidosis IVA (Morquio A). Hum Mutat. 2005 Dec;26(6):500-12.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16287098

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